By obtaining a number of such corresponding points, the translation curve (Fig. 2) is constructed. Fractional weights being inconvenient, the most practical tabulation will probably be as follows:

TRANSLATION TABLE FROM PERCENTAGE GRADES TO WEIGHTS

Grades	Corresponding Weight
0– 50	0
50– 51	1
51– 54	2
54– 67	3
67– 82	4
82– 92	5
92– 97	6
97–100	7
100	8
Very exceptional	9
Practically certain	10

This table will serve our purpose in most cases. One further refinement may be desirable, especially if the observer suspects that his own habit in grading is far from normal; that is, if he is inclined to be either unusually severe or unusually lenient in assigning grades. The article previously referred to contains tables which afford the necessary correction. The writer, for example, is a grader of Type 6 as there classified, and in his case weight 5 corresponds to grades from 77 to 88, instead of from 82 to 92; etc. The difference will not usually be of extreme importance. A still better plan, when the observer makes and grades a very large number of similar observations, is to construct one's own grade distribution curve (corresponding to Fig. 1) from the tabulation of these gradings, and from it to prepare, as above explained, a translation table suited exactly to one's own peculiar grading characteristics.

Summarizing this method of assigning weights to original observations:

1. First grade the observations on a scale of 100 as you would students, averaging together the various factors that may affect their reliability. In doing this, endeavor to maintain the same mental attitude toward the experiments as you would toward the work of a class of students.

2. Then consult the above translation table (or one of your own making) for the proper weights to be assigned.

LeRoy D. Weld

Coe College,
Cedar Rapids, Iowa

THE AMERICAN CHEMICAL SOCIETY. III

DIVISION OF INDUSTRIAL CHEMISTS AND CHEMICAL ENGINEERS

H. S. Miner, *Chairman*

H. E. Howe, *Secretary*

Incendiaries used in modern warfare: Capt. A. B. Ray.

Gas masks in the industries: A. C. Fieldner. The Bureau of Mines is cooperating with the industries in the development of suitable modifications of the Army gas mask for industrial use. In the nine months that have elapsed since the signing of the armistice, the gas mask has made rapid progress in finding a wide application in protecting workmen from poisonous and irritating gases given off in various chemical operations; as for example, chlorine, phosgene, sulphur dioxide, oxides of nitrogen, hydrochloric acid, sulphur chloride and many organic vapors as carbon disulphide, benzol, carbon tetrachloride, aniline, chloroform, formaldehyde, etc. Fire departments have purchased many Army masks for use as smoke protectors. However, they must be used with caution around fires, as they given no protection from carbon monoxide, which may be present in smoky atmospheres. The Army gas mask, when fitted with special canister containing ammonia absorbents, has met with great success for use around refrigerating plants. On the whole, the gas mask is rapidly finding its proper place in the industries. It has not met all the requirements expected, especially in such cases where the workmen must wear it for long periods of time. Experience has shown that they simply will not wear a mask continuously if they can possibly get along without it, but for short periods and in emergencies, it has proved very useful. The possibilities of the gas mask principle are now pretty generally understood, and much improvement in design may be expected within the next year.

The physical character of hydrous ferric oxide: Harry B. Weiser.

Modern commercial explosives: R. H. Hill. Paper disputes the war-developed, current idea

that explosives are necessarily connected with matters of a military nature and attempts to furnish a general knowledge of the modern condition of the industry for the busy man who would like such a general idea of it, but does not find time to review lengthy publications. Subjects discussed are black blasting powder, straight dynamites and gelatin dynamites, non-freezing straight dynamites and gelatin dynamites, ammonia or extra dynamites and gelatin dynamites, permissibles, miscellaneous dynamites and non-freezing dynamites. Strength bases are shown and strength comparisons between commercial dynamites and some important military explosives are given. Developments on lowering the freezing point of nitroglycerine are discussed. Mention is made of various matters requiring chemical or physical control in explosive manufacture and the necessity is shown for such control from the initial preparation of ingredients to the final results of the blast.

Chemicals received by the Bureau of Chemistry during the war: H. E. BUC. During the last four years about 1,300 shipments of chemicals from a large number of dealers and manufacturers have been tested in the Bureau of Chemistry. The greater part of the reagents bore an analysis on the label. Most of the chemicals examined are satisfactory. Occasional impurities are found often enough in chemicals from practically all manufacturers to make it necessary to test all shipments.

Report on the production of synthetic organic chemicals in the Research Laboratory of Eastman Kodak Co., 1918 and 1919: C. E. K. MEES.

SYMPOSIUM ON REFRACTORIES, A. V. BLEININGER, CHAIRMAN

The classification of refractories: G. H. BROWN.

Work of the Technical Department of the Refractories Manufacturers' Association: R. M. HOWE. The Refractories Manufacturers' Association has maintained a central refractories laboratory for over two years. This laboratory is located at the Mellon Institute of Industrial Research of the University of Pittsburgh and serves annually over fifty refractories companies. Small charges are made for the work done and this income makes the system practically self-supporting. The problems investigated are divided into two classes, viz., general and specific. The general problems are not discussed, but the specific problems encountered at different plants are considered briefly. These problems are met with from the time of purchasing a site until the shipment of each load of brick. The owners must know the extensiveness of a deposit before opening it up at a large expense. The miners must have abundant advance information concerning the physical properties of the different clays on the property: they must be able to reject or accept different clays by their hardness, color, structure, size of grain and location. The securing of such data requires the expenditure of considerable money, yet it seems to be justified due to the economical selection of clays, the production of a uniform product, and the avoidance of unjustified construction. The clays, after being mined, are used separately, or mixed with bond clays to secure strength; flint clay to increase the refractoriness and resistance to spalling; alumina to increase refractoriness; silica to decrease the tendency to spall and shrink, and grog for several reasons. After the mixes are fixed, they are worked with water. This is sometimes considered a minor step, but it is now established that the *amount* of water used in tempering plays an important part in determining the final structure of the brick. There is always one definite proportion which is most suited to the production of the densest brick. The *time* used in working clay also enacts an important rôle in determining the final structure a variation in strength amounting to 25 per cent. of the total having been observed when the time was varied. Draw trial curves, which illustrate the behavior of clays at different temperatures, are proving to be of value. They not only tell the manufacturer how his clays must be worked but inform the consumers how the bricks will behave in service. Other factors which concern the process of manufacture are too complicated to report but they can be and are being studied constantly.

The selection of refractories for industrial furnaces: W. F. ROCHOW. Economy in the use of refractories is governed by the selection of the class of material best suited for the purpose, the quality of the brick used and the design of the furnace. Thermal insulation is made practicable under severe temperature conditions by the use of silica brick because of their good mechanical strength at high temperatures. On burning, silica brick undergoes partial inversions from quartzite to cristobalite and tridymite. These inversions are accompanied by permanent volume increases. Recently it has been suggested that the lowering of the specific gravity of silica brick on changing from quartzite to the other crystalline forms, be used as a measure of the extent of this transformation and that well-burned brick should have a

specific gravity of not over 2.38. Some quartzites invert to cristobalite more slowly than others and brick with a lesser content of cristobalite have a lower spalling tendency and also do not show an appreciably greater permanent expansion when subjected to long-continued heating. Brick made from this type of quartzite may be properly burned when inversion has occured to such an extent that its specific gravity is slightly greater than 2.38. Examples with analyses are given. Metal-cased magnesite brick consist of steel containers of square or circular cross section, filled with dead burned magnesite. These are laid as headers in the furnaces. When heated the steel fuses and impregnates the magnesite forming a monolithic lining. Such a lining is more porous than one of magnesite bricks and has the advantage of better withstanding rapid temperature changes. Such bricks may be used in place of magnesia and silica brick in parts of the open hearth steel furnace and in electric steel melting furnaces.

Interesting facts concerning refractories in the iron and steel industry: C. E. NESBITT and M. L. BELL. In this paper the writers state the importance of refractories and emphasize the necessity for their greater efficiency in the iron and steel industry. This improvement can only be accomplished by the cooperation of the producer and the consumer. In the manufacture of iron and steel, refractories meet a wide range of temperature, while destructive agencies such as acid, basic or neutral slags, severe thermal changes, load, abrasion, impact and expansion are present in varying degrees of severity. Tests on refractory brick, easily and rapidly executed, which show a close relation to actual service conditions were developed for determining the resistance to these destructive agencies. The most important working qualities can be determined by two or three tests namely the spalling and hot crushing tests for silica brick, and the spalling, hot load and slagging tests for clay brick. Variations in the life of blast furnace linings, open hearth roofs, converter bottoms soaking pits and ladle linings are mentioned. Results are given showing the marked decrease in crushing strength and increase in spalling of silica brick defective from fire cracks, poor moulding, poor slicking, etc. The writers show the close relationship of the spalling test results with the life obtained in open hearth roofs. The effect of the degree of fineness or size of particles in silica brick is illustrated by results of the spalling test. The effect on certain qualities of clay brick produced by the method of manufacture is illustrated by spalling and load test results. The effect of the degree of fineness and the reduction of strength by heating of clay brick is also shown. From the comparative data it is evident that refractories require most thorough study. Simple practical tests which can be run in quantity and which give data showing variations in quality which reflect on the life of the structure should be adopted. A more uniform product can be secured if a careful study is made of the variations in manufacture which effect the important qualities.

Superior refractories: R. C. PURDY.

Refractory problems in the gas industry: W. H. FULWEILER and J. H. TAUSSIG. In the coal gas process the temperatures range from 400° C. to 1500° C. Rapid changes in temperature and expansion must be considered. Silica material is used in the retorts and the combustion chamber. Fire clay material is used in the recuperators and where the temperature is below 1000° C. In the water gas process the temperature may be 1700° C. in the generator, together with the slagging action due to the ash from the fuel. Abrasion occurring in removing clinker is important. In the carburettor the checker brick are heated to 1200° C. and sprayed with cold oil. Fire clay is used in the generator linings, but other materials are being tried. Cements used in construction frequently do not receive proper attention. Laboratory tests are useful in controlling the quality of materials.

CHARLES L. PARSONS,
Secretary

SCIENCE

A Weekly Journal devoted to the Advancement of Science, publishing the official notices and proceedings of the American Association for the Advancement of Science

Published every Friday by

THE SCIENCE PRESS

LANCASTER, PA. GARRISON, N. Y.

NEW YORK, N. Y.

Entered in the post-office at Lancaster, Pa., as second class matter